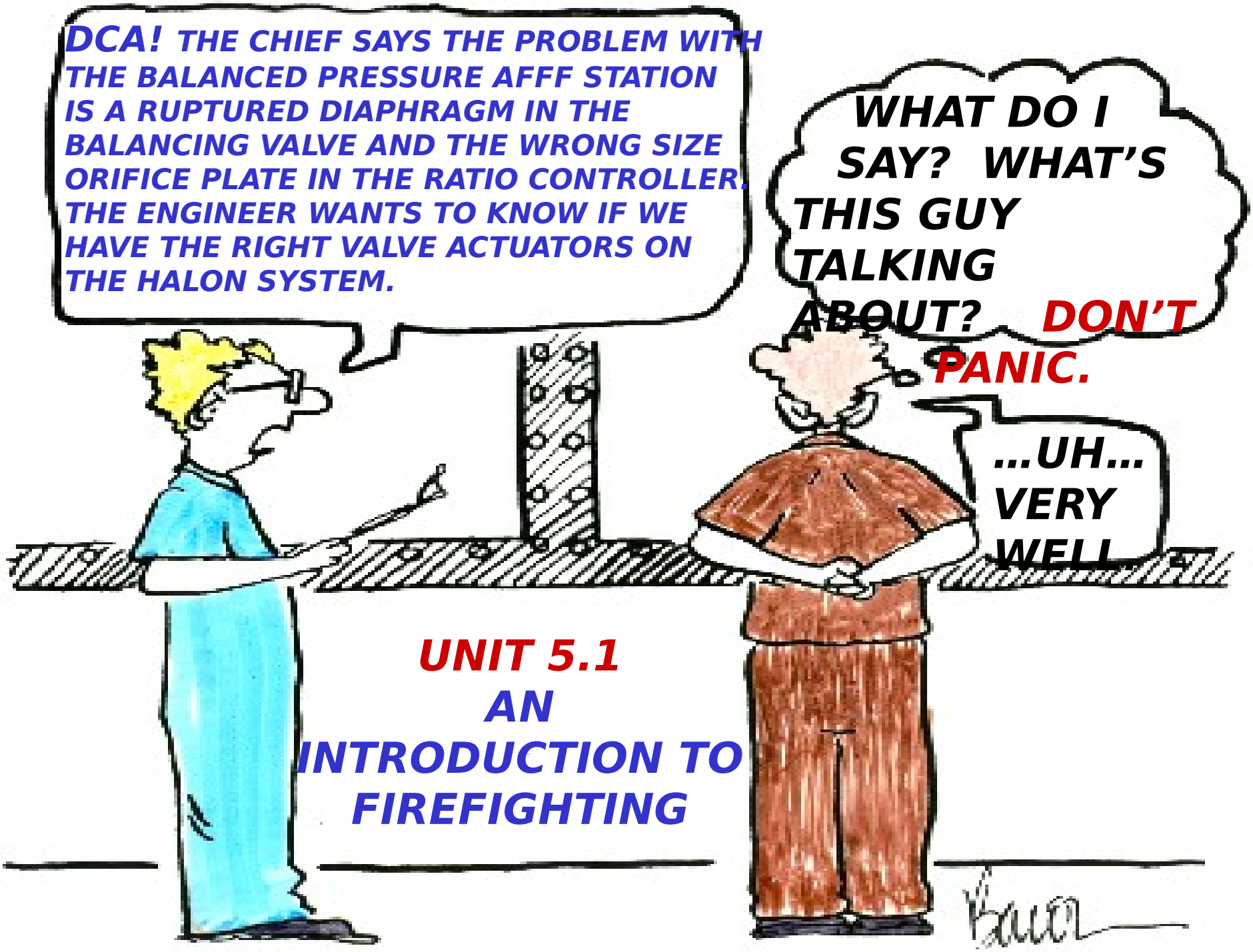
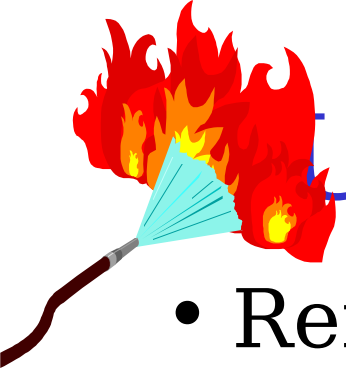
Damage Control Training Program

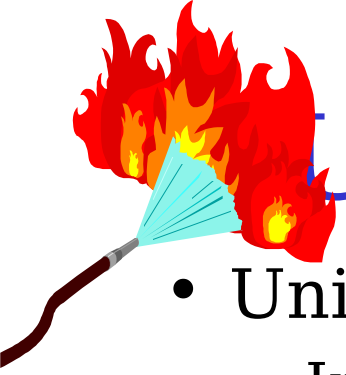
DCC(SW) Chris Hunt


DCA! THE CHIEF SAYS THE PROBLEM WITH THE BALANCED PRESSURE AFFF STATION IS A RUPTURED DIAPHRAGM IN THE BALANCING VALVE AND THE WRONG SIZE ORIFICE PLATE IN THE RATIO CONTROLLER. THE ENGINEER WANTS TO KNOW IF WE HAVE THE RIGHT VALVE ACTUATORS ON THE HALON SYSTEM.
WHAT DO I SAY? WHAT'S THIS GUY TALKING ABOUT?
DON'T PANIC.
...UH... VERY WELL...
UNIT 5.1
AN
INTRODUCTION TO
FIREFIGHTING



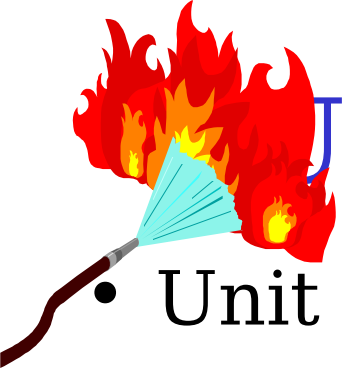
UNIT 5 FIREFIGHTING

- References
  - NSTM 555
  - NWP 3-20.31 Surface Ship Survivability
  - NSTM 077 Personal Protective Equipment
  - Repair Party Manual
  - Look at DC/Firefighting from a new perspective.



UNIT 5 FIREFIGHTING

- Unit 5.1
  - Introduction
- Unit 5.2
  - Organization for a Fire
- Unit 5.3
  - Personnel Protective Equipment
- Unit 5.4
  - Firefighting Techniques
- Unit 5.5
  - OBA Maintenance
- Unit 5.6
  - Portable Equipment
- Unit 5.7
  - AFFF Systems
- Unit 5.8
  - AFFF Test Lab
- Unit 5.9
  - Halon Systems
- Unit 5.10
  - Fixed CO_2 Systems
- Unit 5.11
  - Range Guard/Gaylord Hood

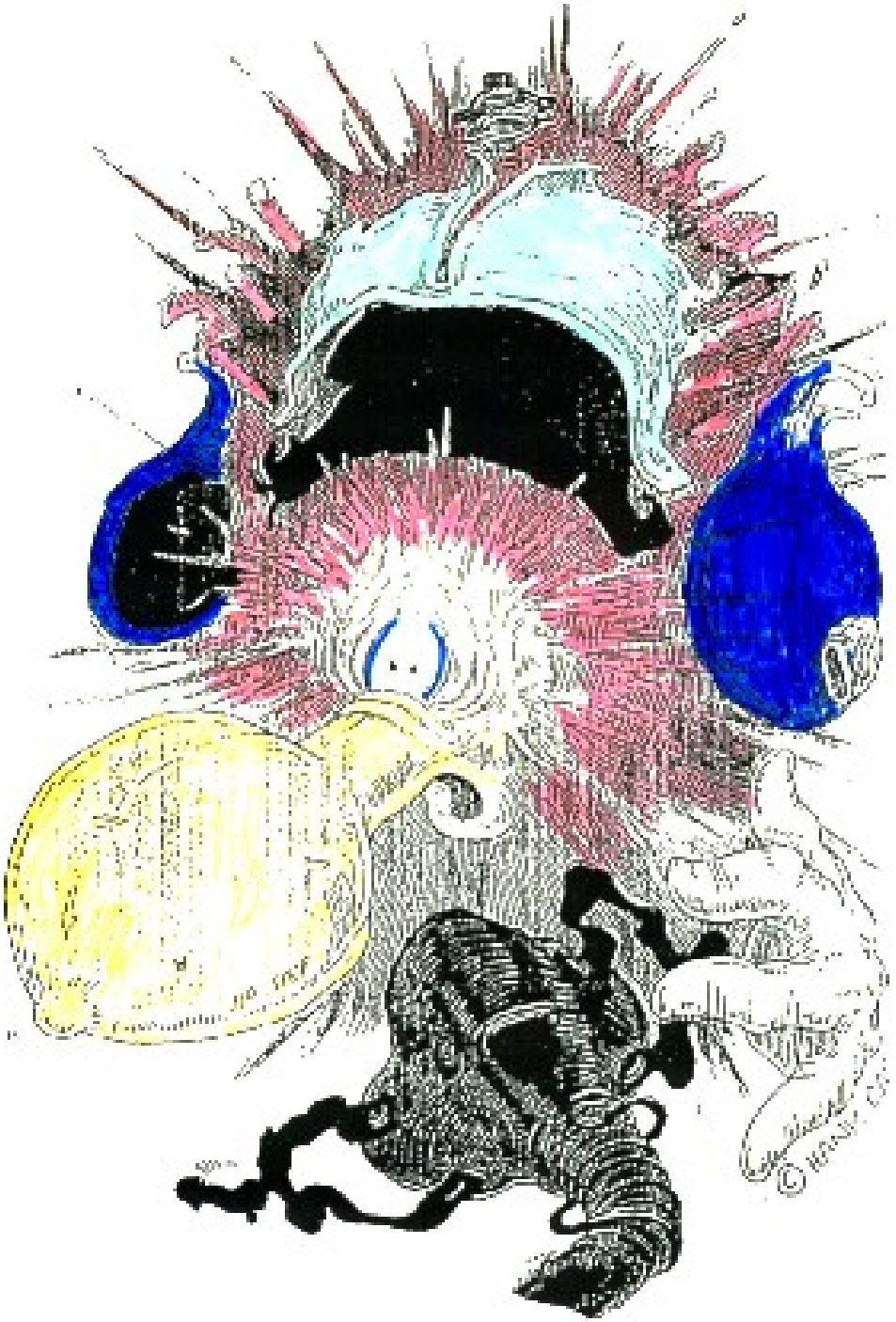


UNIT 5 FIREFIGHTING

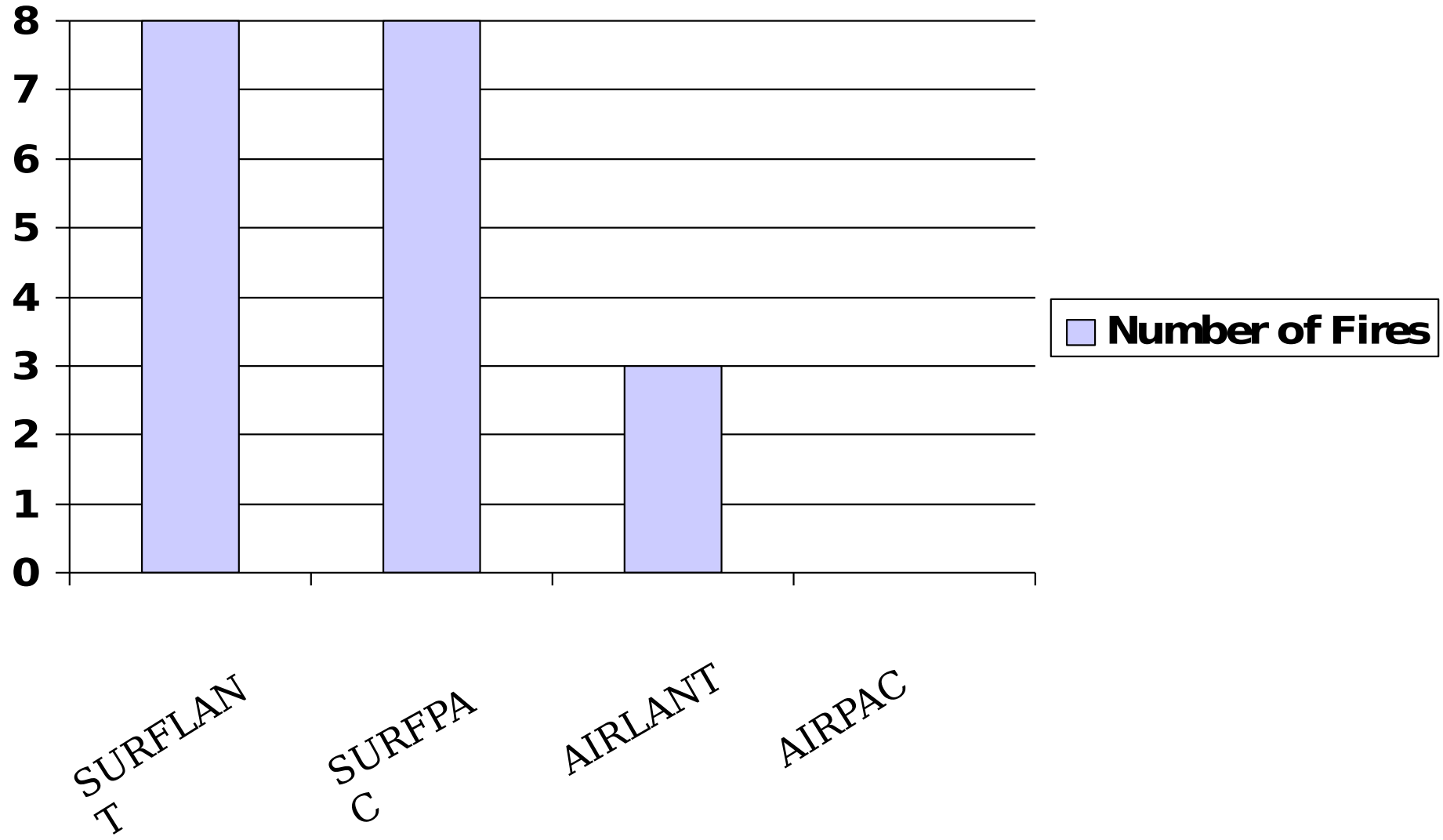
- Unit 5.12
  - Magazine Sprinklers
- Unit 5.13
  - Main Space Fire Doctrine
- Unit 5.14
  - Helo Firefighting
- Unit 5.15
  - Special Hazards Fires

Petroleum based grooming products and oxygen:

DON’T MIX!!

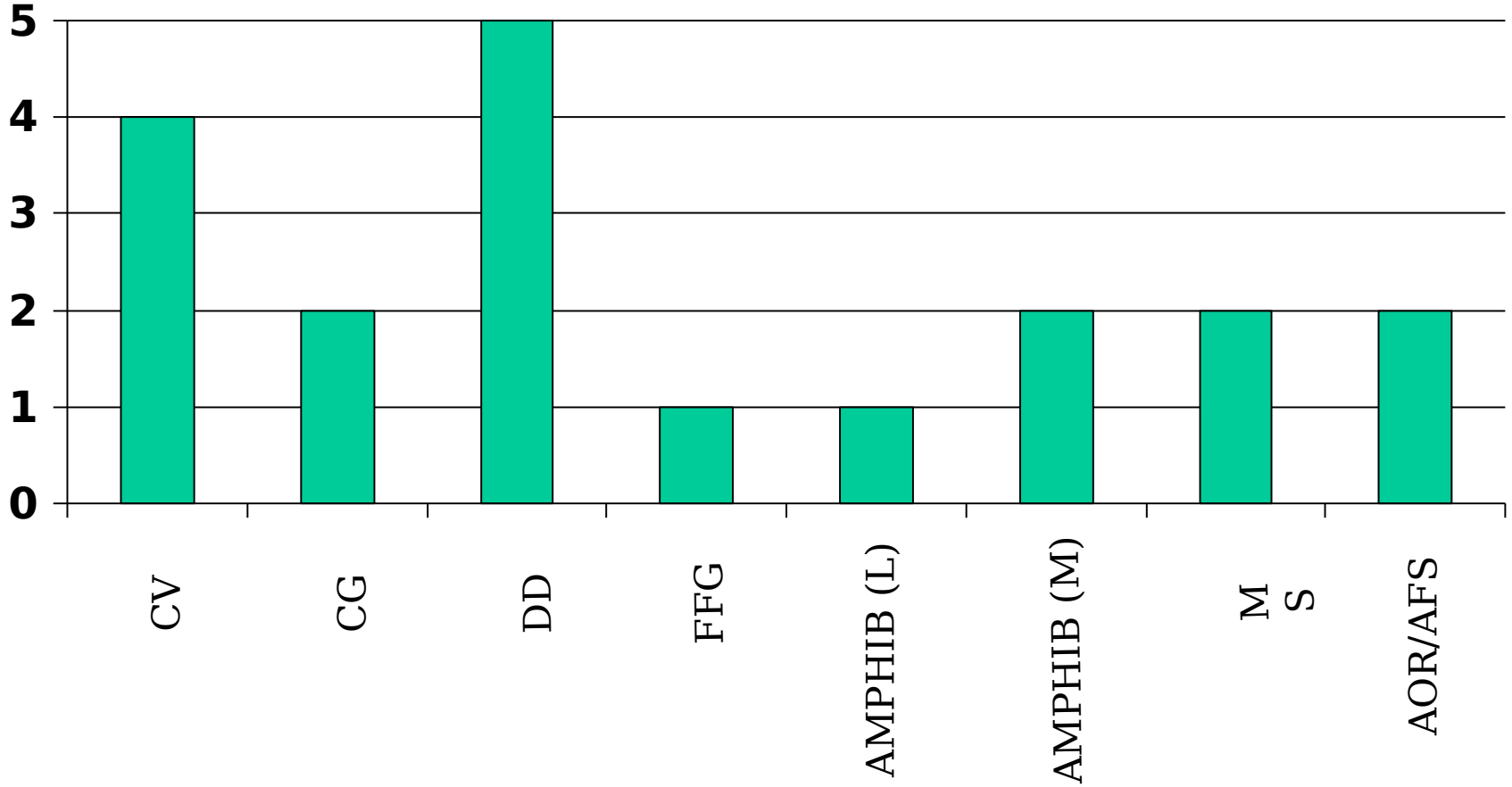


FIRES BY TYCOM



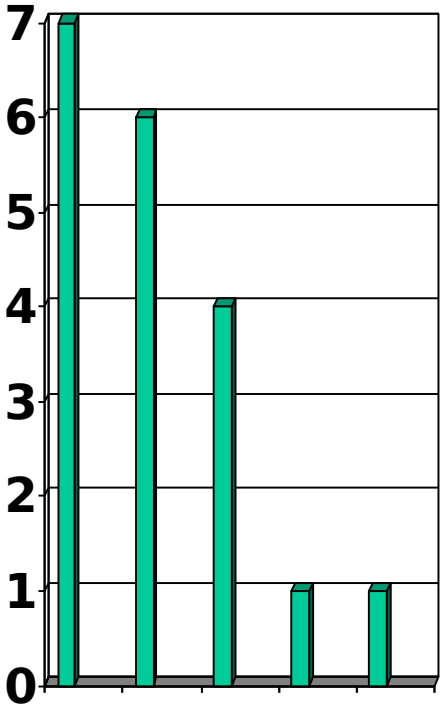
01/01/1995 - 12/31/1996

FIRES BY SHIP TYPE



01/01/1995 - 12/31/1996

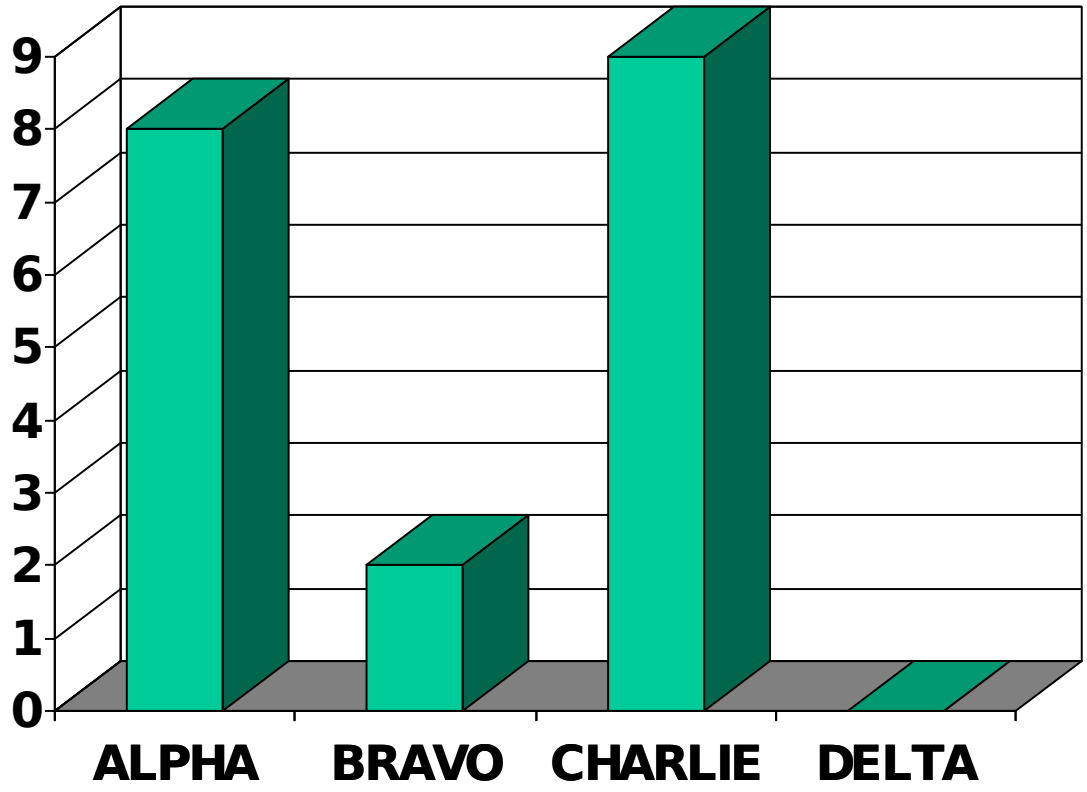
EVOLUTIONS PRONE TO FIRE



- UPKEEP/AVAIL-7
- IND STEAMING-6
- OVERHAUL-4
- FLIGHT OPS-1
- MINESWEEPING-1

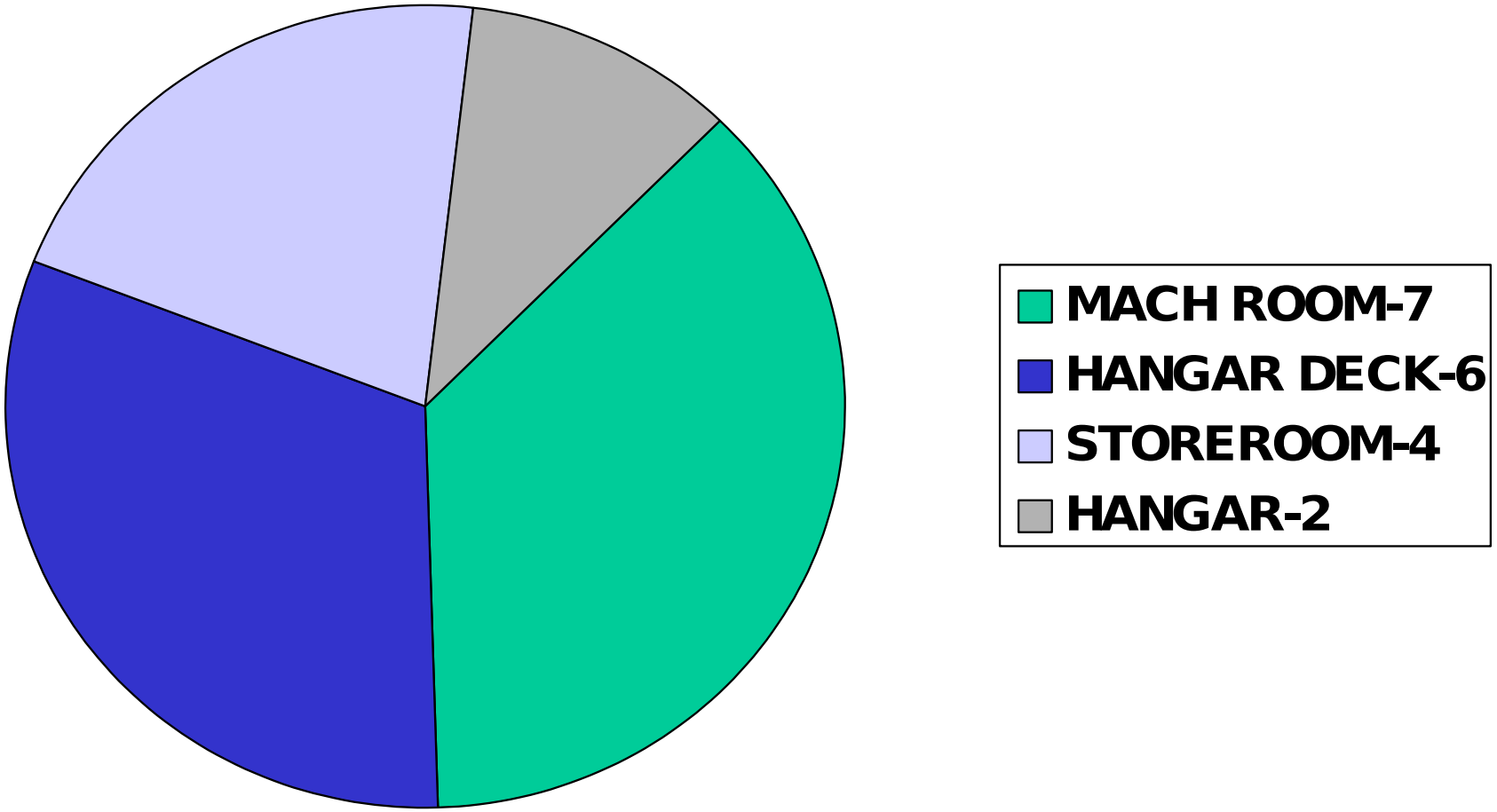
01/01/1995- 12/31/1996

SUMMARY OF FIRES BY CLASS



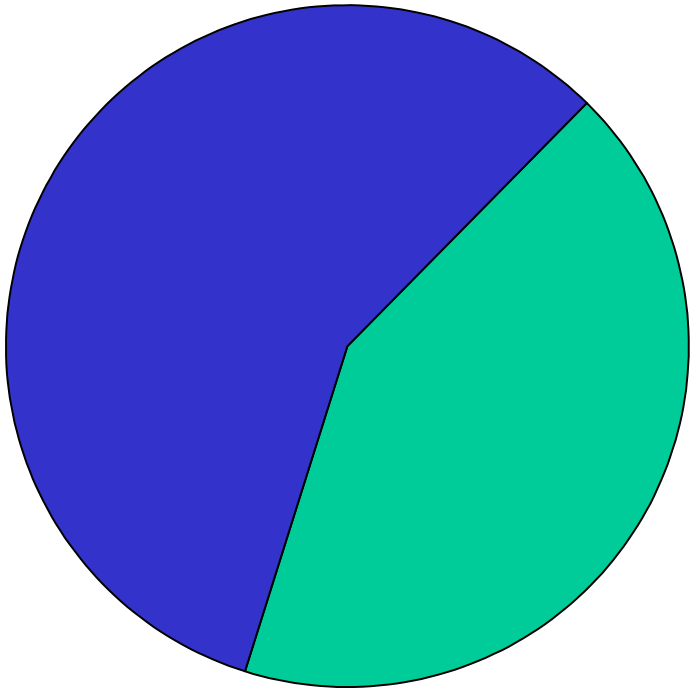
01/01/1995 - 12/31/1996

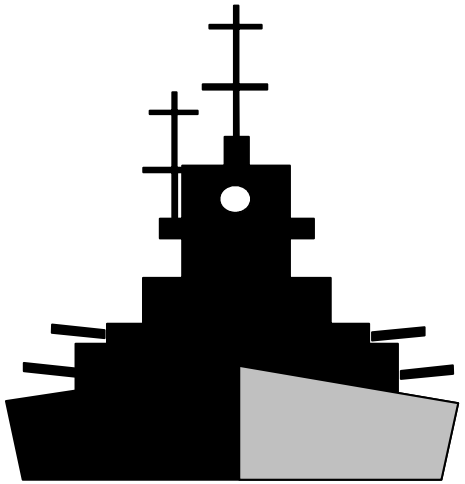
COMPARTMENTS WHERE FIRES OCCUR FREQUENTLY SURFACE SHIPS



01/01/1995 - 12/31/1996

SHIP STATUS





01/01/1994 - 12/31/1995

USS DEYO (DD 989)

CLASS BRAVO FIRE #3 WASTE HEAT BOILER ROOM

- Exhaust gas leaking from the waste heat boiler casing melted the fuel oil head tank sightglass. Fuel spilled onto the deck and ignited.
- Frequent reports of high space temperatures, burning paint and smoke for >8 hours! Engineering Chain of Command did not recognize this as an emergency.
- Primary repair locker was inaccessible due to high temperature and smoke.
- AFFF valves improperly labeled caused foam to be discharged onto Flight deck.

USS DEYO (DD 989)

(Cont'd.)

- No fire drills conducted or procedures established for fire in waste heat boiler room.
- Fire fighting efforts hampered by high heat and dense smoke.
- High heat caused malfunction of a PRP valve, causing the starboard torpedo magazine to flood solid.
- Lack of coordination between repair lockers caused confusion among attack teams.
- Fire fighters had high praise for the newest fire fighting equipment: smoke curtains, fire finder, ram fan.

NAVY TIMES

May 23, 1994

- Pusan, South Korea 0200 7-8 May 1994
- FIRE onboard U.S. flagged merchant ship
- FIRE raged out of control for 8 hours before officials called in **the experts**:
  - Sailors from USS MOBILE BAY and USNS ANDREW J. HIGGINS respond
- Before they were done 22 hours later, 178 sailors from MOBILE BAY and HIGGINS had battled the stubborn blaze.

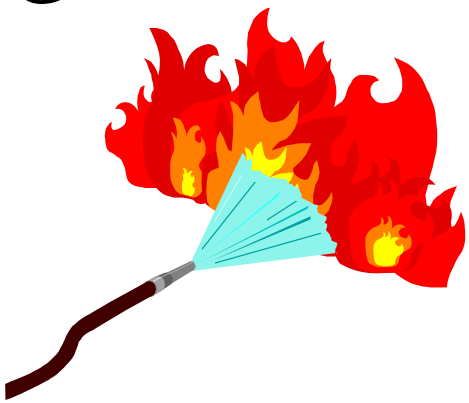
SUMMARY OF FIRES BY COST RANGE

COST	NUMBER OF FIRES	TOTAL COST
>1M	0	$0
200K - 1M	5	$2,253,000
10K - 200K	12	$857,351
<10K	2	$20,000
GRAND TOTAL	19	$3,130,351

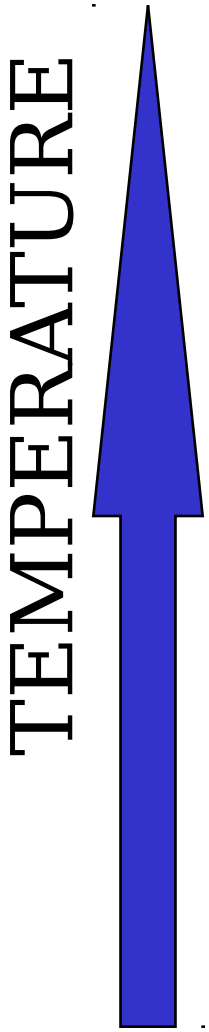
01/01/1995 - 12/31/1996

EFFECTIVE FIRE PREVENTION

- GOOD HOUSEKEEPING
- PROPER STOWAGE OF FLAMMABLES
- FIRE MARSHALL PROGRAM
- GENERAL MAINTENANCE
- WATCHSTANDER TRAINING
- DC ORGANIZATION TRAINING
- ALL HANDS TRAINING



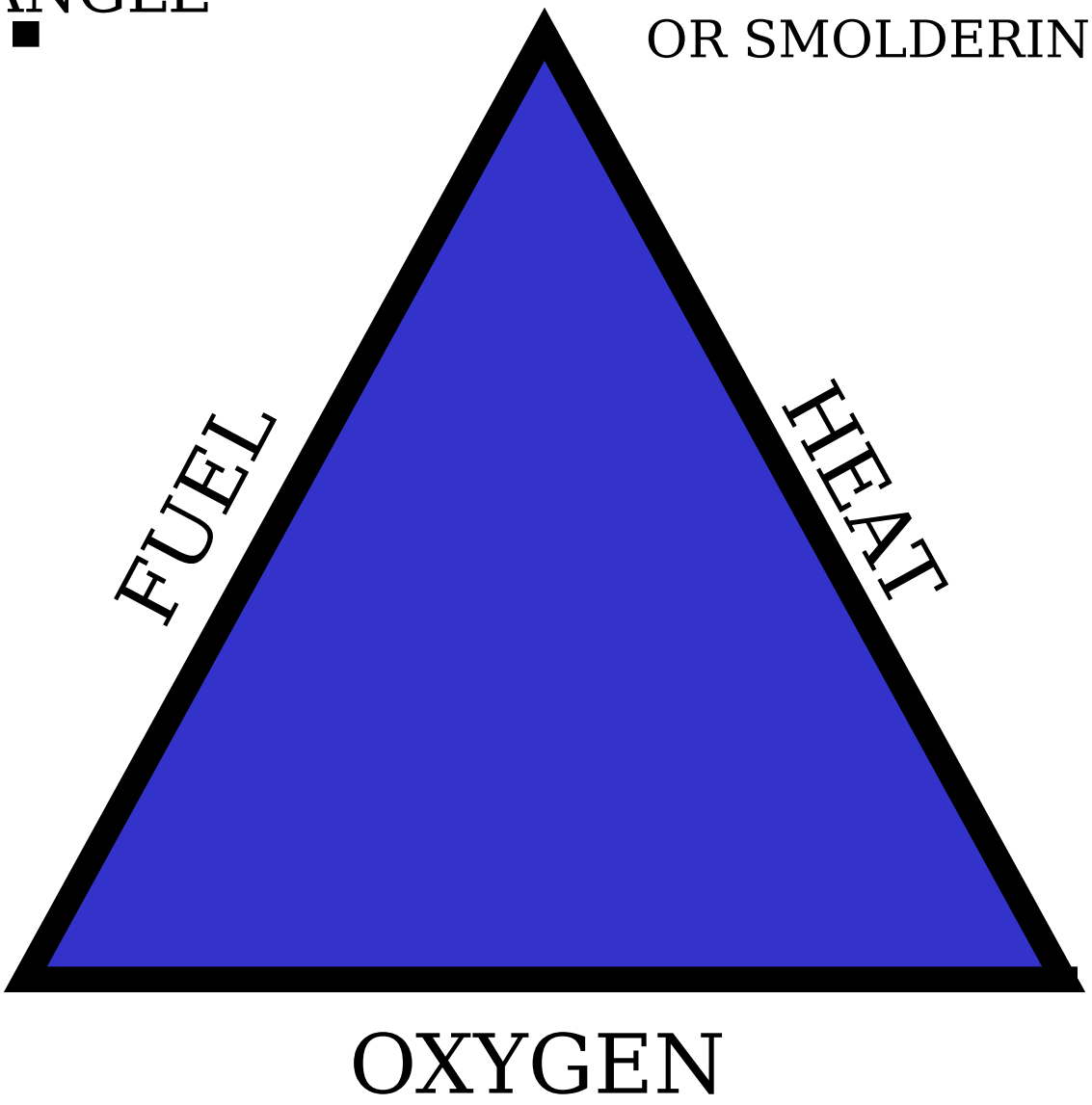
COMBUSTION THRESHOLDS



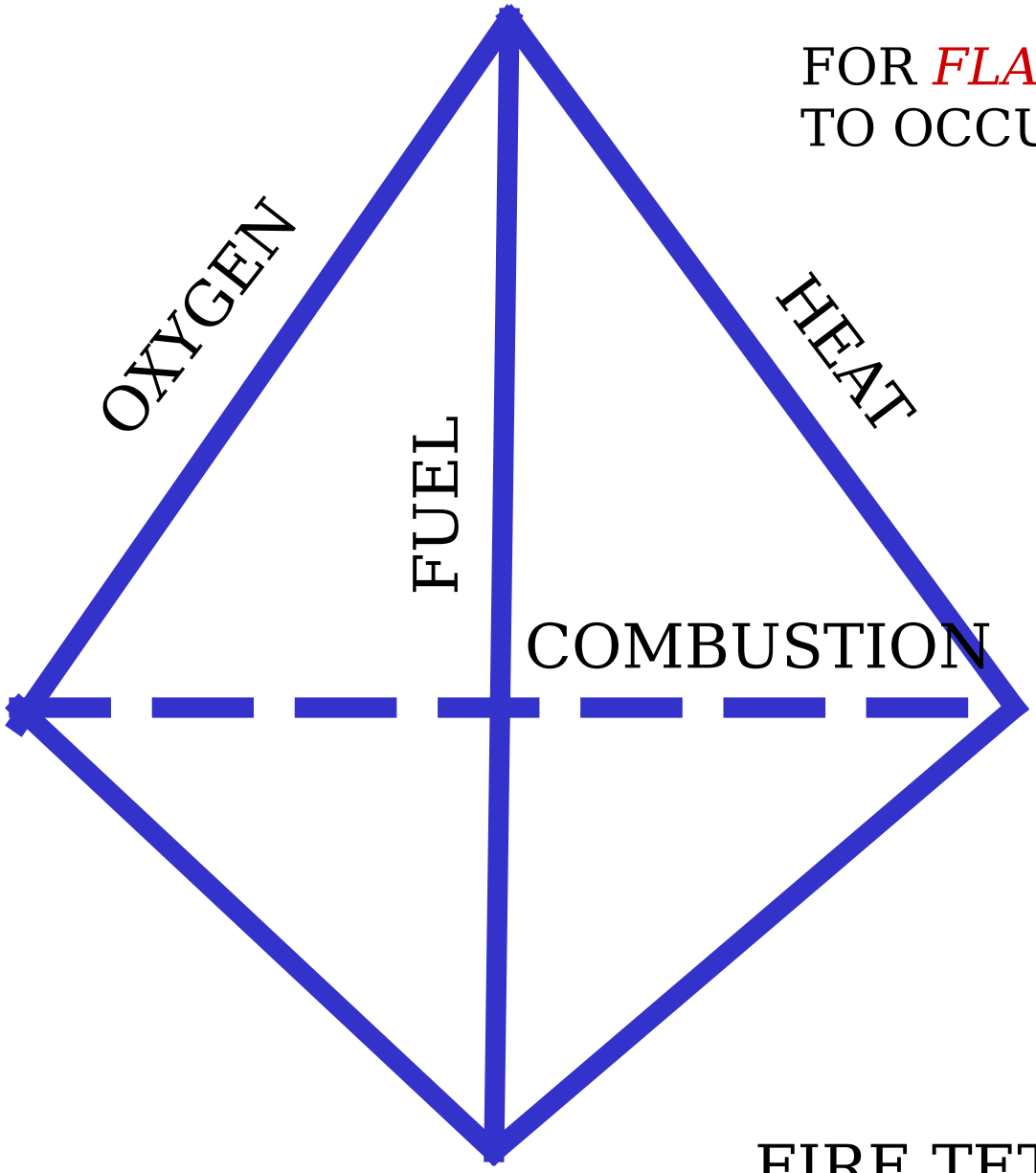
Ignition Temperature	Minimum temperature at which self sustained combustion occurs without an external ignition source.
Fire Point	Temperature at which sufficient vapors are released to support continuous combustion once ignited.
Flash Point	Minimum temperature at which sufficient vapors are released to form an ignitable mixture.

FIRE TRIANGLE

WHERE SURFACE GLOWING
OR SMOLDERING IS OCCURRI



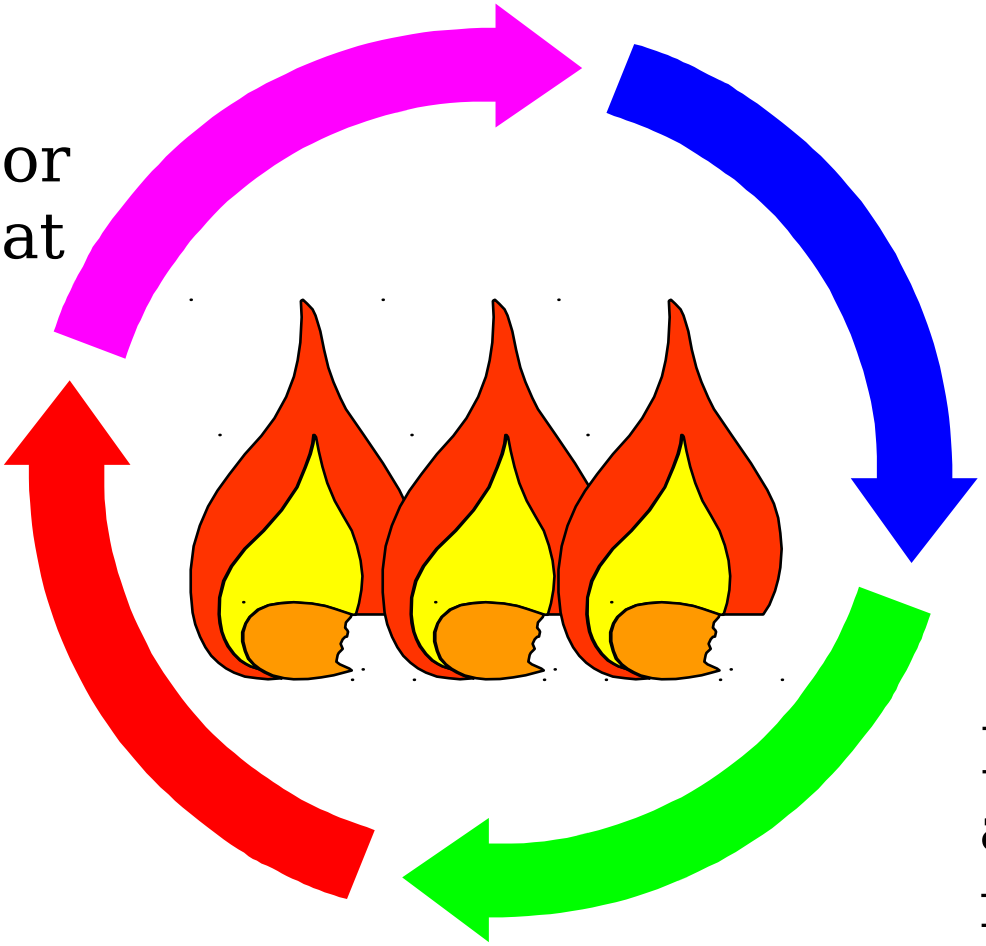
FOR *FLAMING* COMBUSTIO
TO OCCUR:



FIRE TETRAHEDRON

Self sustaining reaction

Burning vapor produces heat



Heat releases and ignites more vapor

LIFE CYCLE OF A FIRE

- 4 STAGES

FIRE DYNAMICS

- GROWTH STAGE
  - Earliest stage of a fire beginning with actual ignition.
  - Fire limited to origin of ignition material.
  - Flame temperature may be well above 1000^{0}F.
  - Some heat being generated. Amount of heat will increase with the progress of the fire.

FIRE DYNAMICS

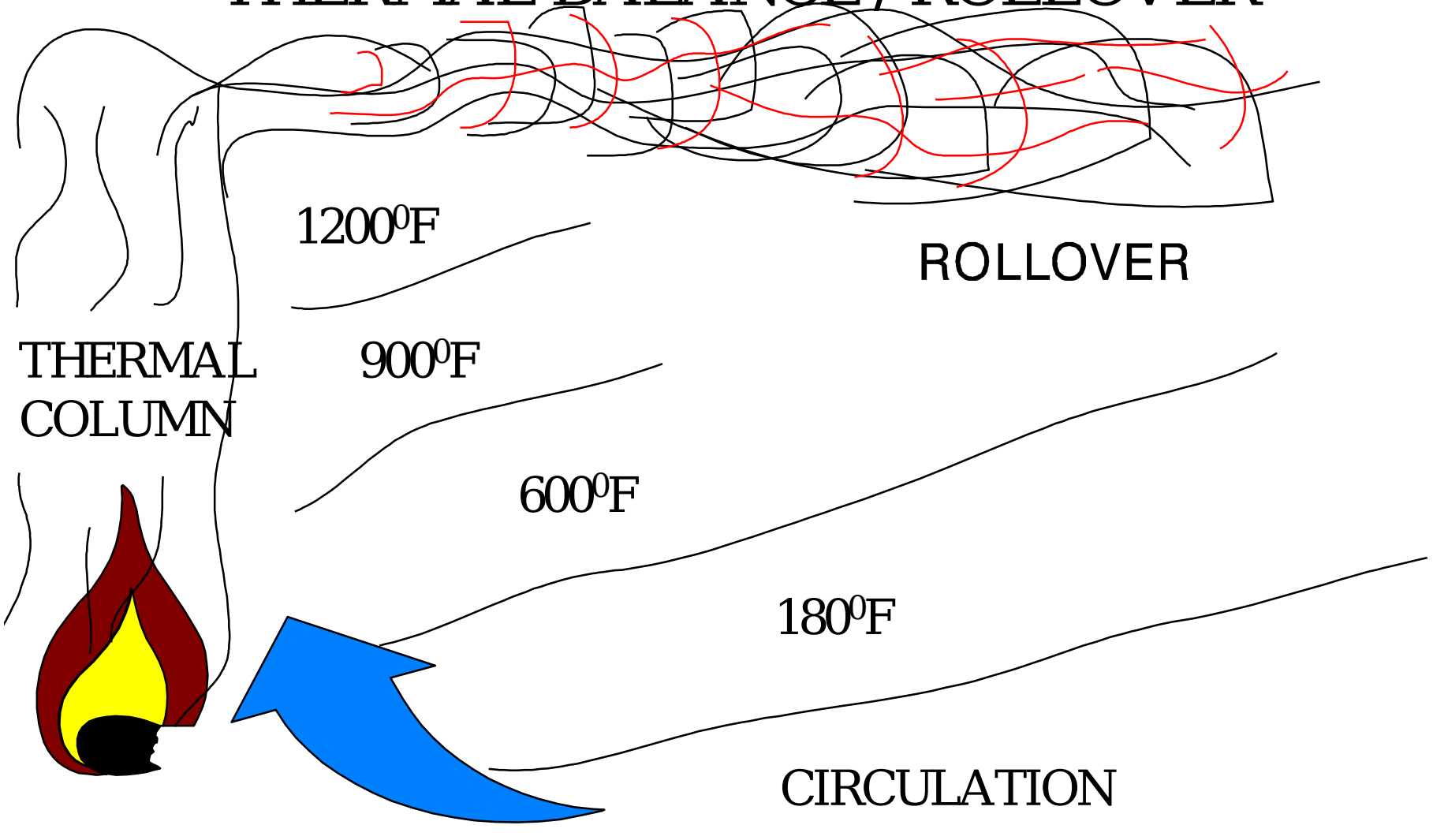
- GROWTH STAGE (cont'd)
  - Sufficient oxygen and fuel are available for fire growth to a point where total involvement is possible.
  - Heat carried to uppermost region of confined area.
  - Heated gases spread laterally from the top and then down.

FIRE DYNAMICS

- GROWTH STAGE (cont'd)
  - Cooler air forced to lower levels.
  - Upper region can exceed 1300^{0}F.

FIRE DYNAMICS

THERMAL BALANCE / ROLLOVER



FIRE DYNAMICS

- FLASHOVER
  - Simultaneous ignition of all contents of the compartment.
  - Normally occurs when the upper gas layer reaches 1100^{0}F.
  - Flashover can also occur in the space above the fire.
  - Can usually be prevented by proper fog application or venting.

FIRE DYNAMICS

- FULLY DEVELOPED STAGE
  - All combustibles in the space have reached their ignition temperature.
  - Burning rate limited by the amount of oxygen available in the air for combustion.
  - Unburned fuel in the smoke may burn as it meets fresh air in adjacent compartments.

FIRE DYNAMICS

- FULLY DEVELOPED STAGE (cont’d)
  - Structural damage to exposed steel normally occurs.
  - Normally inaccessible by hose teams.
  - Best fought using indirect attack.

FIRE DYNAMICS

- DECAY STAGE
  - Available oxygen is consumed or reduced to a point where there is insufficient oxygen to react with fuel.
  - Flame may cease to exist if the area is sufficiently airtight.
  - Burning reduced to glowing embers

FIRE DYNAMICS

- DECAY STAGE (cont'd)
  - If fire continues to smolder, compartment will fill with dense smoke and gases and temperatures could reach well over 1000^{0}C.
  - Intense heat and high concentration of fire gases could produce suitable conditions for a backdraft explosion.

CLASSES OF FIRE

CLASS	FUEL	PREFERRED AGE
ALPHA	PAPER, WOOD, RAGS, MATTRESSES, etc.	WATER
BRAVO	FLAMMABLE LIQUIDS, PAINT, ALCOHOL, etc.	AFFF/PKP
CHARLIE	CONTROLLER MOTORS	CO_2
DELTA	SPECIAL HAZARDS, METALS	JETTISON

EXTINGUISHING METHODS

METHOD	FIRE TETRAHEDRON COMPONENT AFFECTED
COOLING	HEAT
SMOTHERING	OXYGEN
STARVING	FUEL
INTERRUPT COMBUSTION	UNINHIBITED CHAIN REACTION

COOLING AGENTS

- WATER
  - Three forms when using the Vari-nozzle
    - Straight stream
    - Narrow angle fog
    - Wide angle fog
  - High Pressure Water Mist

SMOTHERING AGENTS

- AQUEOUS FILM FORMING FOAM (AFFF)
  - Lighter than most liquid fuels
  - Provides vapor barrier
  - Commonly used on Class “B” fires
  - Clear, amber colored liquid
  - 6% concentrate to 94% water

SMOTHERING AGENTS

- CARBON DIOXIDE
  - Inert gas, heavier than air
  - Preferred agent for Class “C” fires
    - Non-conductive
    - Non-corrosive
    - Leaves no residue
  - No reflash protection

SMOTHERING AGENTS

- CARBON DIOXIDE (cont’d)
  - Hazards
    - Static electricity buildup
    - Suffocation
    - Frostbite

SMOTHERING AGENTS

- AQUEOUS POTASSIUM CARBONATE (APC)
  - Used in the Range Guard system
  - Reacts with burning fat / cooking oil to produce a non-combustible soap-like material that provides a vapor barrier on the surface of the cooking oil.

CHEMICAL INTERRUPTION

- POTASSIUM BICARBONATE (PKP)
  - Chemically alters combustion
  - Quick flame knockdown
  - No reflash protection
  - Commonly used in conjunction with AFFF
  - Personnel Hazards
    - May cause temporary breathing difficulty
    - May interfere with visibility

CHEMICAL INTERRUPTION

- HALON 1301 (MONOBROMOTRIFLUORMETHANE)
  - Extremely effective for Class “B” fires
  - Somewhat effective for Class “A” fires
  - No reflash protection
  - Hazards
    - High velocity discharge
      - Extremely noisy
      - Local turbulence
      - Frostbite

CHEMICAL INTERRUPTION

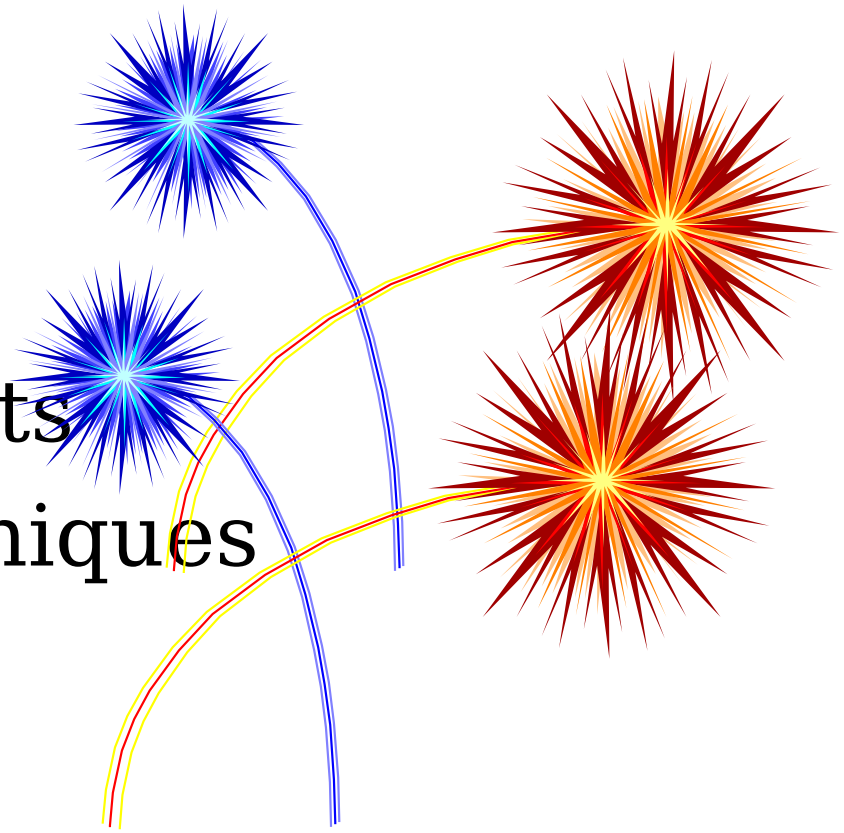
- HALON 1301
  (MONOBROMOTRIFLUORMETHANE)
  - Hazards (cont'd)
    - Toxic decomposition
      - Hydrogen bromide
      - Hydrogen fluoride

STARVING

- Jettison burning material
- Isolate burning fuel from other fuel sources

SUMMARY

- Unit Introduction
- Facts / figures
- Fire terminology
- Extinguishing agents
- Extinguishing techniques



Review Question #1

- Name the 4 primary fire extinguishing methods and briefly describe each.
  - Cool / Apply water from vari-nozzle
  - Smother / Apply CO_2, AFFF, APC
  - Starve / Secure or remove fuel source, jettison burning material overboard
  - Interrupt Combustion / Apply Halon 1301, PKP

Review Question #2

- What are some of the elements of an effective fire prevention program?
  - GOOD HOUSEKEEPING
  - PROPER STOWAGE OF FLAMMABLES
  - FIRE MARSHALL PROGRAM
  - GENERAL MAINTENANCE
  - WATCHSTANDER TRAINING
  - DC ORGANIZATION TRAINING
  - ALL HANDS TRAINING

INTRO TO FIREFIGHTING

UNIT 5.1